

IN THE CLAIMS:

1. (Currently Amended) An electric press apparatus ~~having a connecting mechanism~~  
comprising:

a base plate formed into a flat plate shape;

a plurality of guide bodies provided so that one end portions thereof intersect at  
5 right angles with the base plate;

a flat plate shaped support plate provided at the other end portions of the guide bodies  
so as to intersect at right angles with the guide bodies;

a slide plate provided so as to be slidably moved between the base plate and the support  
plate by being guided by the guide bodies;

10 a first motor for driving the slide plate slidably with respect to the guide bodies;

a ball screw shaft which is connected to the output shaft of the first motor and is  
pivotally supported so as to be moved in parallel with the guide bodies with respect to the  
support plate;

a nut member threadedly engaged with the ball screw shaft; and

15 a differential mechanism, the upper end of which is fixed to the nut member and the  
lower end of which is fixed to the slide plate, for slightly changing the contact position between  
the ball screw shaft and balls incorporated in the nut member,

the slide plate being moved vertically by the normal and reverse rotations of the ball  
screw shaft driven by the first motor, whereby a workpiece mounted on the base plate is  
20 subjected to fixed point working, characterized in that

the differential mechanism of the ~~connecting mechanism~~ comprises:

a frame body in which

an opening of four inner wall surfaces corresponding to an opening portion  
hollowed out substantially into a rectangular parallelepipedic shape is provided in the upper  
25 surface,

a stripe of slide groove is provided at a bottom surface portion in inner wall  
surface of one set of opposed surfaces of two sets of opposed surfaces,

and the rectangular parallelepipedic opening portion forms a rigid body;

a movable body which

30 has an upper plate portion having an inclined surface portion the top surface of  
which is horizontal and the back surface of which is inclined,

a stripe of slide groove formed on the back surface side of the upper plate  
portion,

has a hole, which allows the ball screw shaft to pass through, in the central  
35 portion,

is fitted in the opening of the frame body,

and the nut member is fixed to the surface thereof;

a differential member which

has a first guide engagement portion, which slidingly engages with the slide  
40 groove formed in the frame body, in the lower end portion,

has a second guide engagement portion, which slidingly engages with the

slide groove formed on the back surface side of the movable body, in the upper end portion,

has a lower surface portion being horizontal and an upper surface portion  
45 being inclined,

has a hole, which allows the ball screw shaft to pass through, in the central portion,

and has a wedge shape fitted so as to be slidable in the frame body;  
a screw shaft for moving the differential member in the horizontal direction; and  
50 a second motor for moving the differential member in the horizontal direction via the screw shaft of the differential mechanism.

2. (Currently Amended) The electric press apparatus ~~according to~~ in accordance with claim 1, ~~characterized in that~~ wherein the slide groove formed on the back surface side of the upper plate portion of the movable body has a surface inclined along the inclined surface of the back surface of the upper plate portion.

3. (Currently Amended) The electric press apparatus ~~according to~~ in accordance with claim 2, ~~characterized in that~~ wherein the ~~first~~ second guide engagement portion formed on the differential member has a surface inclined corresponding to the inclined surface of the back surface of the upper plate portion of the movable body.

4. (Currently Amended) The electric press apparatus ~~according to any of claims 1 to 3~~ in accordance with claim 1, characterized in that further comprising a lid body for connecting opposed surfaces to each other, said lid body is provided between two sets of opposed surfaces of the four inner wall surfaces of the frame body.

5. (Currently Amended) An electric press apparatus ~~having a connecting mechanism~~ comprising:

a base plate formed into a flat plate shape;

a plurality of guide bodies provided so that one end portions thereof intersect at  
5 right angles with the base plate;

a flat plate shaped support plate provided at the other end portions of the guide bodies so as to intersect at right angles with the guide bodies;

a slide plate provided so as to be slidably moved between the base plate and the support plate by being guided by the guide bodies;

10 a first motor for driving the slide plate slidably with respect to the guide bodies;

a ball screw shaft which is connected to the output shaft of the first motor and is pivotally supported so as to be moved in parallel with the guide bodies with respect to the support plate;

a nut member threadedly engaged with the ball screw shaft; and

15 a differential mechanism, the upper end of which is fixed to the nut member and the lower end of which is fixed to the slide plate, for slightly changing the contact

position between the ball screw shaft and balls incorporated in the nut member,

the slide plate being moved vertically by the normal and reverse rotations of the ball screw shaft driven by the first motor, whereby a workpiece mounted on the base plate is subjected to fixed point working, characterized in that

the differential mechanism ~~of the connecting mechanism~~ comprises:

a frame body in which

an opening of four inner wall surfaces corresponding to an opening portion hollowed out substantially into a rectangular parallelepipedic shape is provided in the upper surface,

a stripe of slide groove is provided at a bottom surface portion in inner wall surface of one set of opposed surfaces of two sets of opposed surfaces,

and the rectangular parallelepipedic opening portion forms a rigid body;

a movable body which

has an upper plate portion having horizontal surfaces on the top surface and the back surface thereof,

a stripe of slide groove formed on the back surface side of the upper plate portion,

has a hole, which allows the ball screw shaft to pass through, in the central portion,

is fitted in the opening of the frame body,

and the nut member is fixed to the surface thereof;

a differential member which

has a first guide engagement portion, which slidably engages with the slide  
40 groove formed in the frame body, in the lower end portion,

has a second guide engagement portion, which slidably engages with the slide  
groove formed on the back surface side of the movable body, in the upper end portion,

has an upper surface portion being horizontal and a lower surface portion  
being inclined,

45 has a hole, which allows the ball screw shaft to pass through, in the  
central portion,

and has a wedge shape fitted so as to be slidable in the frame body;

a screw shaft for moving the differential member in the horizontal direction; and

a second motor for moving the differential member in the horizontal direction via  
50 the screw shaft of the differential mechanism.

6. (Currently Amended) The electric press apparatus ~~according to~~ in accordance with  
claim 5, ~~characterized in that~~ wherein the slide groove formed on the back surface side of the  
upper plate portion of the movable body has a horizontal surface along the back surface of the  
upper plate portion.

7. (Currently Amended) The electric press apparatus ~~according to~~ in accordance with  
claim 6, ~~characterized in that~~ wherein the surface of the slide groove of the frame body has an

inclined surface along the inclined surface of the lower surface of the differential member, and the ~~second~~ first guide engagement portion formed on the differential member has a surface inclined corresponding to the inclined surface of the lower surface of the differential member.

8. (Currently Amended) The electric press apparatus ~~according to any of claims 5 to 7~~ in accordance with claim 5, ~~characterized in that~~ further comprising a lid body for connecting opposed surfaces to each other, said lid body is provided between two sets of opposed surfaces of the four inner wall surfaces of the frame body.

9. (Currently Amended) A differential mechanism ~~of connecting mechanism~~ used in an electric press apparatus ~~having a connecting mechanism~~ comprising:

a base plate formed into a flat plate shape;

a plurality of guide bodies provided so that one end portions thereof intersect at right angles with the base plate;

a flat plate shaped support plate provided at the other end portions of the guide bodies so as to intersect at right angles with the guide bodies;

a slide plate provided so as to be slidably moved between the base plate and the support plate by being guided by the guide bodies;

a first motor for driving the slide plate slidably with respect to the guide bodies;

a ball screw shaft which is connected to the output shaft of the first motor and is pivotally supported so as to be moved in parallel with the guide bodies with respect to the

support plate;

a nut member threadedly engaged with the ball screw shaft; and

15 a differential mechanism, the upper end of which is fixed to the nut member and the lower end of which is fixed to the slide plate, for slightly changing the contact position between the ball screw shaft and balls incorporated in the nut member,

the slide plate being moved vertically by the normal and reverse rotations of the ball screw shaft driven by the first motor, whereby a workpiece mounted on the base  
20 plate is subjected to fixed point working, characterized in that

the differential mechanism ~~of the connecting mechanism~~ comprises:

a frame body in which

an opening of four inner wall surfaces corresponding to an opening portion  
hollowed out substantially into a rectangular parallelepipedic shape is provided in the upper  
25 surface,

a stripe of slide groove is provided at a bottom surface portion in inner wall  
surface of one set of opposed surfaces of two sets of opposed surfaces,

and the rectangular parallelepipedic opening portion forms a rigid body;

a movable body which

30 has an upper plate portion having an inclined surface portion the top surface of which is horizontal and the back surface of which is inclined,

a stripe of slide groove formed on the back surface side of the upper plate  
portion,



35 has a hole, which allows the ball screw shaft to pass through, in the central  
portion,  
is fitted in the opening of the frame body,  
and the nut member is fixed to the surface thereof;  
a differential member which  
has a first guide engagement portion, which slidably engages with the slide  
40 groove formed in the frame body, in the lower end portion,  
has a second guide engagement portion, which slidably engages with the  
slide groove formed on the back surface side of the movable body, in the upper end portion,  
has a lower surface portion being horizontal and an upper surface portion  
being inclined,  
45 has a hole, which allows the ball screw shaft to pass through, in the central  
portion,  
and has a wedge shape fitted so as to be slidable in the frame body;  
a screw shaft for moving the differential member in the horizontal direction; and  
a second motor for moving the differential member in the horizontal direction via  
50 the screw shaft of the differential mechanism.

10. (Currently Amended) The differential mechanism according to claim 9, ~~characterized~~  
~~in that~~ wherein the slide groove formed on the back surface side of the upper plate portion of  
the movable body has a surface inclined along the inclined surface of the back surface of the

upper plate portion.

11. (Currently Amended) The differential mechanism ~~according to~~ in accordance with claim 10, ~~characterized in that~~ wherein the ~~first~~ second guide engagement portion formed on the differential member has a surface inclined corresponding to the inclined surface of the back surface of the upper plate portion of the movable body.

12. (Currently Amended) The differential mechanism ~~according to any of claims 9 to 11~~ in accordance with claim 9, ~~characterized in that~~ further comprising a lid body for connecting opposed surfaces to each other, said lid body is provided between two sets of opposed surfaces of the four inner wall surfaces of the frame body.

13. (Currently Amended) A differential mechanism ~~of connecting mechanism~~ used in an electric press apparatus ~~having a connecting mechanism~~ comprising:

a base plate formed into a flat plate shape;

a plurality of guide bodies provided so that one end portions thereof intersect at right angles with the base plate;

a flat plate shaped support plate provided at the other end portions of the guide bodies so as to intersect at right angles with the guide bodies;

a slide plate provided so as to be slidably moved between the base plate and the support plate by being guided by the guide bodies;

10 a first motor for driving the slide plate slidably with respect to the guide bodies;  
a ball screw shaft which is connected to the output shaft of the first motor and is  
pivottally supported so as to be moved in parallel with the guide bodies with respect to  
the support plate;  
a nut member threadedly engaged with the ball screw shaft; and  
15 a differential mechanism, the upper end of which is fixed to the nut member and  
the lower end of which is fixed to the slide plate, for slightly changing the contact position  
between the ball screw shaft and balls incorporated in the nut member,  
the slide plate being moved vertically by the normal and reverse rotations of the  
ball screw shaft driven by the first motor, whereby a workpiece mounted on the base  
20 plate is subjected to fixed point working, characterized in that  
the differential mechanism ~~of the connecting mechanism~~ comprises:  
a frame body in which  
an opening of four inner wall surfaces corresponding to an opening portion  
hollowed out substantially into a rectangular parallelepipedic shape is provided in the upper  
25 surface,  
a stripe of slide groove is provided at a bottom surface portion in inner wall  
surface of one set of opposed surfaces of two sets of opposed surfaces,  
and the rectangular parallelepipedic opening portion forms a rigid body;  
a movable body which  
30 has an upper plate portion having horizontal surfaces on the top surface and the

back surface thereof,

a stripe of slide groove formed on the back surface side of the upper plate portion,

has a hole, which allows the ball screw shaft to pass through, in the central portion,

is fitted in the opening of the frame body,

and the nut member is fixed to the surface thereof;

a differential member which

has a first guide engagement portion, which slidably engages with the slide groove formed in the frame body, in the lower end portion,

has a second guide engagement portion, which slidably engages with the slide groove formed on the back surface side of the movable body, in the upper end portion,

has an upper surface portion being horizontal and a lower surface portion being inclined,

has a hole, which allows the ball screw shaft to pass through, in the central portion,

and has a wedge shape fitted so as to be slidable in the frame body;

a screw shaft for moving the differential member in the horizontal direction; and

a second motor for moving the differential member in the horizontal direction via the screw shaft of the differential mechanism.

14. (Currently Amended) The differential mechanism ~~according to~~ in accordance with claim 13, ~~characterized in that~~ wherein the slide groove formed on the back surface side of the upper plate portion of the movable body has a horizontal surface along the back surface of the upper plate portion.

15. (Currently Amended) The differential mechanism ~~according to~~ in accordance with claim 14, ~~characterized in that~~ wherein the surface of the slide groove of the frame body has an inclined surface along the inclined surface of the lower surface of the differential member, and the ~~second~~ first guide engagement portion formed on the differential member has a surface  
5 inclined corresponding to the inclined surface of the lower surface of the differential member.

16. (Currently Amended) The differential mechanism ~~according to any of claims 13 to~~  
15 in accordance with claim 13, ~~characterized in that~~ further comprising a lid body for  
connecting opposed surfaces to each other, said lid body is provided between two sets of  
opposed surfaces of the four inner wall surfaces of the frame body.